The Canadian Entomologist.

LXXVIII JULY, AUGUST, 1946 No. 7, 8

COLEOPTERA NOTES I: SILPHIDAE

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Under this general title, I plan to publish from time to time taxonomic and biologic notes on several groups of Coleoptera in which I am particularly interested. This paper discusses the characters and habits of four species and adds some general observations on the family Silphidae.

Silpha littoralis L.

The typical form of this Holarctic species may be found throughout Europe and Northern Asia. In North America east of the Rocky Mountains is a maculate form to which Fabricius' name *surinamensis* is applicable.

The typical Eurasian *littoralis* always has the elytra immaculate; males have a double row of spines on the inner apical angle of the enlarged hind femur; hind tibia of males is usually straight; females have stout setae on the inner apical angle of the paraproct.

The North American specimens have the apical portion of the elytra marked with a row of red spots that may merge into a bar, or the elytra may be immaculate. The hind femur of the male is enlarged and bears a large spine on the inner apical margin; the hind tibia may be straight or arcuate and may have a cuspidate tubercle on the inner apical third; females usually have weak setae on the inner apical angle of the paraproct. The degree of enlargement of the hind femora of the males of both forms varies considerably.

In my revision* I did not elaborate on the reasons for considering *surinamensis* Fab. a form of *littoralis* L. In the several collections I studied are a few specimens from North America with immaculate elytra. Inasmuch as the Eurasian specimens are always immaculate, I considered the possibility of both species living in North America. However, in arranging all of the material so as to distinguish *littoralis* L. from *surinamensis* Fab., I discovered that the character of the elytra markings and the secondary sexual characters usually used to separate the two would not classify all specimens. Then after an examination of the female genitalia for a possible character, it appeared that the relative width of the setae on the paraprocts might be a diagnostic feature for the two named forms. But a specimen from Canada with red elytra markings had setae as stout as the specimens from Eurasia. A summary of the characters of the two populations is given in the accompanying table.

Approximately one hundred and fifty specimens from North America east of the Rockies, France, Hungary, Sweden, and Siberia were examined. From this study the following conclusions are drawn: The American population has variable characters. The red fasciae on the elytra may be extensive, limited, or absent; males have enlarged hind femora with an inner apical spine varying to a double row of spines, and the hind tibiae with or without a cuspidate tubercle on the inner apical third; females usually have weak setae on the inner apical angle of the paraproct of the genitalia, but the setae may be as strong as those found on specimens from the Eurasian fauna. The characters of the Eurasian population are more stable. The elytra are immaculate; males have enlarged hind femora and a straight hind tibia; females have stout setae on the inner apical angle of the paraproct of the genitalia. However, this seta character is not noticeable unless specimens of both types are at hand. Eurasian specimens thus fall within the range of variation of the American population. From these data I

*Jn. N. Y. Ent. Soc., 52:1-25, 1944.

conclude *surinamensis* Fab. is merely a described color form of *littoralis* L. and therefore may be considered a synonym.

There is the interesting possibility that *littoralis* of Europe may have been introduced from North America inasmuch as it shows less variation than the North American specimens, which might indicate fewer genetic possibilities and mean a more recent population. This would also explain its absence from the West Coast of North America and from Eastern Asia.

SILPHA LITTORALIS L.

MORPHOLOGICAL VARIATION OF SPECIMENS STUDIED

Character	Variation	Eurasian Population	American Population
Setae on inner apical angle of female paraproct	Weak	0%	88%
	Stout	100%	12%*
Inner apical angle of hind femora of male	Large Spine	0%	70%
	Double row of spines	100%	30%
Hind tibia of male	Straight	90%	50%**
	Arcuate	10%	50%
Hind tibia of male: Cuspidate tubercle on inner apical third	With	0%	50%**
	Without	100%	50%
Elytra	Immaculate	100%	10%*
	Maculate	0%	90%

* The specimens in my collection with stout setae on the paraproct are not the ones with immaculate elytra.

** The specimens with the straight hind tibia of the male are not necessarily the ones that lack the cuspidate tubercle. Some have the tubercle.

Thanatophilus ramosa Say

Casey described* *aenescens* as differing from *ramosa* Say by the metallic coloration of the thorax and elytra. After examining the Casey type, I came to the conclusion, as have others before me, that it differed from Say's *ramosa* only in the somewhat metallic color of the chitin. I have a series of specimens that may be placed in this category. But the coloration is so variable that it is difficult to decide whether some specimens are metallic or not. An examination of the female genitalia of the two forms did not provide characters which would separate them. Secondary sexual characters found on the apical angles of the elytra do not appear to be constant. It is not possible to place all specimens in one group or the other. I failed to find any constant character which would separate the two. Therefore until such a character can be found to distinguish these forms, *aenescens* Casey should be considered a synonym of *ramosa* Say.

Nicrophorus carolinus Fab.

The Milnes'† interesting paper on the behavior of *Nicrophorus* records observations on the burying habits of three species, *N. tomentosus, marginatus,* and *orbicollis.* Leech‡ previously reported N. *vespilloides* (under the name *conversator* Walk.) as having burying habits. To these four Nearctic species I wish to add a fifth, *Nicrophorus carolinus* Fab.

In late October, 1943, at Avon Park, Florida, I observed two pairs of this species on a recently killed snake of the genus *Thamnophis.* The snake was lying at the edge of a path in rather loose sand. The beetles walked around the snake for a while and then began to excavate beneath its body by the "plowing method," as described by the Milnes. All four beetles worked independently and seemed little concerned with the presence of the others. Finally the snake's body rested in a trough with only the tail protruding. This process took about an hour. This done, the beetles ceased work and re-examined the entire snake. At this point one of the beetles, that later proved to be a female, seized the snake

*Bull. Calif. Acad. Sc., 2:171, 1886.
†Jn. N. Y. Ent. Soc., 52:311-327, 1944.
‡Proc. Ent. Soc. B. C., 31:36-40, 1935.

by the tail with her head and forelegs, and pushing sand with her hind legs, began to back into the sand, digging a hole as she went. Slowly the snake began to disappear. The other beetles continued to examine the cadaver and made no attempt to help its movements. In the course of two hours the entire snake had disappeared below ground except for a portion of the head. This was covered by a mound of sand by the female when she reappeared later. When the snake was nearly three-fourths underground, the remaining three beetles ceased their examination and wandered off. Fearing they would not return, I captured them. After the female had covered the head to her satisfaction she re-entered her tunnel. I then dug into the sand to determine the position of the snake and captured the female. The snake was lying parallel to the ground, about three to six inches below the surface.

Nicrophorus hybridus Hatch & Angell

The range of this species is given as North America west of the Mississippi River. However Hatch* lists a questionable New Jersey record. In the collection of the author are specimens taken on the Ennis farm, near Medina, New York, which verify its existence east of the Mississippi, and constitute a new record for New York State.

SILPHIDS IN TROPICAL LOWLANDS

While on a recent assignment in Panama, I attempted to collect Silphids. I examined carrion of various types as well as decaying vegetable matter. During my entire stay of twenty months not a single Silphid was observed. A review of the distribution of the larger members of this family shows that a majority of the species inhabit the Holarctic Region. Very few species are to be found in the tropical regions of the world, except in mountainous areas. The reason for this, I have been forced to conclude, is that although carrion is present in the area, it is not a suitable breeding place. All of the larger carcasses are immediately devoured by vultures; the smaller ones are eaten by hordes of ants and swarms of flies, or, if perchance some is missed, it is completely desiccated in a few hours by the hot sun. Thus there is not enough time for the beetles to complete their life cycle before the habitat is destroyed.

COLOR PATTERN IN SILPHIDS

Many names have been proposed for the various forms of coloration in the Silphids, especially in the genus *Nicrophorus*. These names are defended† on the basis that they give a "handle" by which we can talk about these variations. Although they may not be of value to the economic entomologist, it is stated that they are of value to the taxonomist in that they describe the range within the species. It is true that many descriptions are written without a word as to the differences of the individuals. A discussion of these forms should be included. If any correlation between these variations and the portions of the range of the species can be shown, then one of these subspecific names may be utilized for a geographic race. Such a name would be useful to the economic worker as well as the taxonomist. But to name the so-called aberrations and not to figure them seems rather worthless. When a large series of specimens is examined from any one locality, these patterns are found to intergrade and this is true throughout the range‡. The problem to be considered if these populations are to be named is whether the coloration is due to environment or to genetic factors. If it is environment, then it may surely be disregarded. If it is genetic, and that can only be proven by extensive laboratory studies, then the geneticists must be consulted for the proper terminology to be applied to the form. However, from a practical view-point, if species or subspecies were named on the basis of genetic color patterns, the number of names might run into the thousands and, obviously, that would be very cumbersome.

*Jn. N. Y. Ent. Soc., 35:359, 1937.
†Hatch, Jn. N. Y., Ent. Soc., 48:233-244, 1940.
‡Leech, Bull Brooklyn Ent. Soc., 32:156-159, 1927.

If any one population were to show a rather constant pattern, and the variants were at the outer limits of the area only, and if about ninety percent from one area could be assigned one name, then the names would be of value even if these were "micro-populations" with very restricted ranges. This does not seem to be true in Silphidae. It would seem, then, best not to name these populations and to consider only specific names based on morphological characters until all forms have been thoroughly worked over as to habits, range and genetic characteristics.

ACKNOWLEDGEMENTS

I am indebted to several people for suggestions and criticisms and especially to Prof. Melville H. Hatch for his many valuable suggestions and criticisms in several personal communications.

NEW AMERICAN BUTTERFLIES

BY DON B. STALLINGS AND J. R. TURNER

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Boloria freija nabokovi new race

This giant race of the species *freija* Thun. was collected along the Alaska Military Highway in British Columbia. In size and wing shape this would appear to be a race of *frigga* Thun. rather than of *freija,* and we have no doubt but that those who depend on external characters only will insist that we are in error; nevertheless gentalic study leaves no doubt as to its true relationship with *freija.*

This race is distinguished from *freija* by its larger size, the difference in wing shape (which is more like that of *frigga saga* Staud.), and the fact that both wings are heavily suffused with black on both surfaces, so much so that the normal brown ground color is nearly obliterated. It is distinguished from *freija tarquinius* Curt. by its larger size, the difference in wing shape, and the heavier black suffusion. We have two specimens of *tarquinius* from Baffinland, neither of which shows any black suffusion on the under surfaces. This new race has the black suffusion well developed on the under surfaces, especially on the hind wings, the white markings thereon being well covered with black. The normal black markings in this race are heavier than in either *freija* or *tarquinius.*

In order to give a better idea of the difference in wing shape, we give below a series of measurements of various specimens of this species. On the fore-wing the length is the distance from the base of the wing to the apex, and the width is the distance from the apex to the inner angle. On the hindwing the length is the distance from the base of the wing to vein Rs where it meets the margin of the wing. The width is the distance from $Sc+R_1$ to 2dA, in each case from where they meet the margin of the wing.

Place Collected	Date	Fore-wing Length	Fore-wing Width	Hind-wing Length	Hind-wing Width
Alaska Mil. Hi	7/23/43	20.5 mm.	14 mm.	15.8 mm.	15.8 mm.
Baffinland	7/28/42	18.0	11.0	12.2	11.0
Berthoud Pass, Colo.	7/4/41	18.75	12.75	13.0	11.5
Same	7/4/38	19.0	12.0	13.0	11.8
Harlan, Sask.	5/9/42	18.4	11.2	13.0	11.1
Same	5/9/42	18.5	12.2	12.75	11.8
Riding Mt., Man.	6/6/29	19.75	12.75	13.8	12.2

It will be noted that the fore-wing of the other specimens averages 63.9% as wide as long, while in *nabokovi* the fore-wing is 68.3% as wide as it is long.

In the hind wing, the other specimens average 89.4% as wide as long, while *nabokovi* shows no difference. The measurment set out above for *nabokovi* were taken from the holotype.

Holotype: Male. Alaska Military Highway, July 23, 1943, Mile 102, North of Summit 2, Ravine, Elevation 6000 ft. Collector: D. S. Correll.

Paratype: One male. Same data.

We name this distinctive race after V. Nabokov who is contributing so much to our American literature on Lepidoptera.

The drawing was kindly prepared by Paul Grey.

Holotype and paratype returned to the Museum of Comparative Zoology at Cambridge, Mass., from which we received the specimens on loan.

Since preparing the original description of *nabokovi* we have secured a copy of the *Report of the Canadian Arctic Expedition*, 1913-18, Vol. III, Part 1: Lepidoptera, by Arthur Gibson in which he pictures a male and female of his *natazhati*. We realized at once that *nabokovi* was closer to *natazhati* than to either typical *freija* or *tarquinius*, particularly in wing shape. Further correspondence with several authorities on the genus brings forth the information that they treat *natazhati* as a race of *freija*. Gibson himself mentions the close relationship. This note is added to call attention to the difference between *nabokovi* and *natazhati*. *Nabokovi* is larger and the black suffusion is more developed. In fact the black on the two specimens of *nabokovi* (both males) is heavier and more complete than on the female pictured by Gibson.

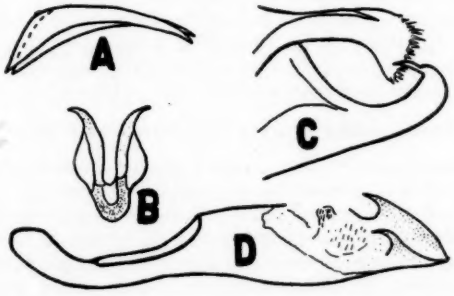

Fig. 1. Details of male genital armature of *Boloria freija nabokovi*. A, left lateral view of uncus; B, cephalic view of anellus; C, left lateral view of distal portion of valve; D, left lateral view of aedeagus.

Boloria toddi jenistai new race

There has been considerable revisional work done with this group in recent years and the butterfly that we once knew as *Brenthis bellona* (Fabr.) is now properly classified as *Boloria toddi ammiralis* (Hem.). In examining long series of this species, we arrive at the conclusion that specimens occurring around Lloydminster, Sask., are worthy of a racial name.

Typical *toddi* from the interior of Labrador are in the words of Holland: "Characterized by the fact that both the fore and hind wings, with the exception of the outer submarginal band, are heavily suffused with dark brown, so that the maculation apparent in typical *B. bellona* is almost lost to the eye; furthermore the marginal spots and those of the next inner row are confluent and thus present the appearance of a heavy dark brown outer border."

Toddi, on the average, has a wing expanse of 39 mm. and is confined to northeastern North America. *Ammiralis* is larger than *toddi* and is found south of it. In both *toddi* and *ammiralis* the brown ground color of the upper surfaces has a yellowish cast.

Race *jenistai* has the bases of both wings on the upper surfaces suffused with dark brown as in *toddi,* but to a lesser degree. The marginal row of spots and those of the next inner row are not confluent but are separated as in *ammiralis.* The brown ground color of the upper surfaces has a red cast and the entire upper surfaces appear to be lightly covered with smoke or dust; thus the specimens do not have the fresh, bright appearance of *toddi* and *ammiralis.* On the under surfaces the brown ground color has a red cast; otherwise it is similar to more eastern specimens, except that the purplish-brown sheen that occurs on the outer half of the hindwing is much more strongly developed in *jenistai.*

Females have a lighter brown ground color on upper surfaces with the red cast more strongly developed on the inner half of the wings than on the outer half. The dust-like covering occurs. The dark brown suffusion at base of wings is minute. The black maculation is not as developed as in the males. On under surfaces, similar to males but lighter.

Holotype: Male. Expanse 41 mm. Lloydminster, Sask., 5/27/41. Collected by Richard Fitch.

Allotype: Female. Expanse 41 mm. Lloydminster, Sask. 5/8/41. Same collector.

Paratypes: 68 males and 5 females collected at Lloydminster and Haidan, Sask., during May, June and July, 1941 to 1945, by same collector.

Holotype and allotype will be placed in the National Museum at Washington, D. C.

This race is named in honor of our good friends, Mr. and Mrs. Harry E. Jenista who have joined us on so many collecting trips.

Manitoba specimens seem to be intermediate between *toddi* and *jenistai.* Specimens from Ft. St. John, B. C., should be assigned to this race. Two specimens from Camrose, Alberta, probably are of this race, although they do not appear to have the dusty appearance of the type series.

Neonympha gemma freemani new race

This race, which seems to be confined to the tropical zone, is immediately distinguished from typical *gemma* by the red-brown ground color of both surfaces of both wings, whereas *gemma* has a yellow-brown ground color. (The longer specimens are in cabinets, the more easily this difference is seen.) The fringes of *freemani* are darker than in *gemma;* the two black marginal spots on the upper surface of the secondaries are distinct and are faintly edged with red on the inward side; this red becomes very distinct on most females.

On the under surfaces of the wings of both sexes there are uniform striations of darker red-brown, more developed than in *gemma.* The transverse red-brown lines are not as well developed as in *gemma.* On the under surfaces of the secondaries, the four marginal black spots are edged outwardly with silver which has a slight golden tint. Inwardly the four spots are edged with yellowish powdering.

Holotype: Male. Expanse 31 mm. Pharr, Texas. Oct. 28, 1944. Collected by H. A. Freeman.

Allotype: Female. Expanse 35 mm. Pharr, Texas. Oct. 26, 1944. Collected by H. A. Freeman.

Paratypes: 31 males and 19 females. Collected at Pharr, Texas, during May, Aug., Sept., and Oct., 1944, and March, April, and May, 1945. Brownsville, Texas, during June, 1940, and August, 1944. San Benito, Texas, no date.

Named in honor of our good friend and fellow collector, H. A. Freeman. Holotype and allotype to be placed in National Museum at Washington, D.C.

Neonympha gemma freemani form **hiemalis inductura** new form

Both *gemma* and *freemani* have a winter form, quite distinct from the summer form. This seasonal form of *freemani* is described herewith. The one form name should be sufficient for the winter forms of both *freemani* and *gemma.*

Upper surfaces: Ground color generally darker, with markings on under surfaces showing through.

Lower surfaces: A coating of darker coloring laid over the ground color, particularly in a broad band between the two inward transverse lines, on both wings. This is repeated in the marginal area, giving the under surfaces a marked banded effect. The transverse red-brown lines are well developed and continuous.

The banded effect will instantly distinguish *inductura* from *freemani*.

Holotype: Male. Expanse 30 mm. Pharr, Texas. Dec. 25, 1944. Collected by H. A. Freeman.

Allotype: Female. Expanse 31 mm. Same data at holotype.

Paratypes: 14 males and 9 females. Collected at Pharr, Texas, during Nov. and Dec., 1944 and Jan., 1945, by H. A. Freeman. Edinburg, Texas, Febr., 1945, collected by Mr. and Mrs. Jay Hilton. San Benito, Texas, no date.

Holotype and allotype to be placed in the National Museum at Washington, D. C.

Euphydryas anicia howlandi new race

Genitalic examination proves this race to belong to the species *anicia*.

This race is nearest *eurytion* Mead, but the markings are much more distinct. The fringe of both wings is white, checked with black at the vein points. The marginal red band on the upper primaries is separated from a second red band by a narrow irregular black line, the second red band being less than half as wide as the marginal band. Inside the second red band is a well defined black band, on the inner half of which is a series of white spots. Inside of the black band is another red band, well broken with cross lines of black. Inside this red band, on the upper half of the wing is a white bar followed by a red bar, then a white bar, then a red bar, then a white spot tinged with red and surrounded with black. The red and white bars are separated from each other by black lines. Inside of the last mentioned red band, on the lower half of the wing, is a black bar with some red showing through; this is followed by a white bar, which in turn is followed by a red spot, and finally a black area next to the body.

The upper surfaces of the lower wings have a well developed marginal red band; this is followed by a band of white spots, narrowly outlined with black, followed by a band of red spots, more strongly outlined with black, followed by a well deveoped band of white spots, narrowly outlined with black, and finally an irregular basal band, red at the top and black at the bottom, enclosing three white spots.

The under surfaces heavily marked, particularly the hindwings, with the white band having a slight yellow cast and the red bands being a bright dark color. The black lines outlining the bands are narrow.

The female is very similar to the male, except that the black markings on both surfaces are more developed. On the upper surface of the forewings, the female differs from the male in having the second marginal red band, inside the irregular black line, showing some white on the inner side of the red.

This race is distinctive due to the deep reddish coloring. We have seen no other *anicia* in which the red is so bright and deep. It is more like the red found in some *chalcedona*. Howland reports, "They seem to favor ridges or pinnacles, usually rocky ground, open patches in wooded foothills of the mountains at 7000 to 8000 feet elevation". The type series was collected by H. A. Howland, for whom we name the race.

Holotype: Male. Expanse 39 mm. Polaris, Montana. June 14, 1941.

Allotype: Female. Expanse 46 mm. Polaris, Montana. June 26, 1941.

Paratypes: 171 males, 21 females, Polaris, Montana. Collected during May, June and July, 1941 and 1943.

Holotype and allotype to be placed in the National Museum at Washington, D. C.

STUDIES ON PARASITES OF THE SPRUCE BUDWORM, *ARCHIPS FUMIFERANA* (Clem.) *

2. Life History of *Glypta fumiferanae* (Viereck) (Hymenoptera, Ichneumonidae)

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ABSTRACT

All stages of the spruce budworm parasite *Glypta fumiferanae* (Viereck) are described in this paper. Illustrations of all stages are presented.

INTRODUCTION

The reasons for undertaking the study of this insect and the general circumstances surrounding its development are the same as those dealt with in a previous paper (1) to which the reader is referred. A short account of the life history of the host has also been given in the same paper and the technique and methods are essentially the same in each.

The existence of an unpublished manuscript on *Glypta fumiferanae* by Dr. J. D. Tothill (6) was made known to the writer after the essential features contained herein had been worked out. This manuscript was in the files of the Forest Insect Laboratory, Fredericton, N. B., and was made available through the courtesy of Mr. R. E. Balch, Officer-in-charge of the laboratory. The following account of the life history is based on work carried out by the writer, and Tothill's manuscript is referred to only when it is at variance with the former.

From the dissection and rearing of winter-collected larvae it has been demonstrated that the parasite overwinters in hibernating budworm larvae, either as an egg or a very young larva. As in *Apanteles fumiferanae* (1) the time of emergence of adult parasites coincides with the hatching of the budworm eggs. In the spring the parasite develops in the feeding budworm larva and emerges as a full-fed larva from fifth or sixth stage budworms. A detailed description of the stages of *Glypta fumiferanae* is given below. Measurements of each larval stage are presented in the accompanying table (Table 1). The nomenclature of Vance and Smith (7) was adopted in the description of the mouth parts.

TABLE 1

Measurements of *Glypta fumiferanae* (Viereck) (in mm.)

Larval Stage	Length		Width		Head Width		Length of caudal appendage		No. of individuals
	Range	Average	Range	Average	Range	Average	Range	Average	
Early 1st	1.034–1.397	1.272	0.099–0.176	0.136	0.110–0.154	0.125	0.418–0.627	0.524	3
Late 1st	0.825–1.452	1.207	0.088–0.308	0.203	0.088–0.132	0.102	0.066–0.275	0.189	10
Combined 1st	0.825–1.452		0.088–0.308		0.088–0.154		0.066–0.627		13
2nd	0.880–2.585	1.832	0.176–0.528	0.338	0.154–0.330	0.236	0.165–0.407	0.266	29
3rd	1.738–6.569	3.550	0.374–1.321	0.649	0.242–0.714	0.467	0.071–0.352	0.202	26
4th	7.854–11.067	8.979	0.714–2.356	1.544	0.821–1.000	0.946			4

DESCRIPTION OF THE STAGES OF *GLYPTA FUMIFERANAE* (Viereck)

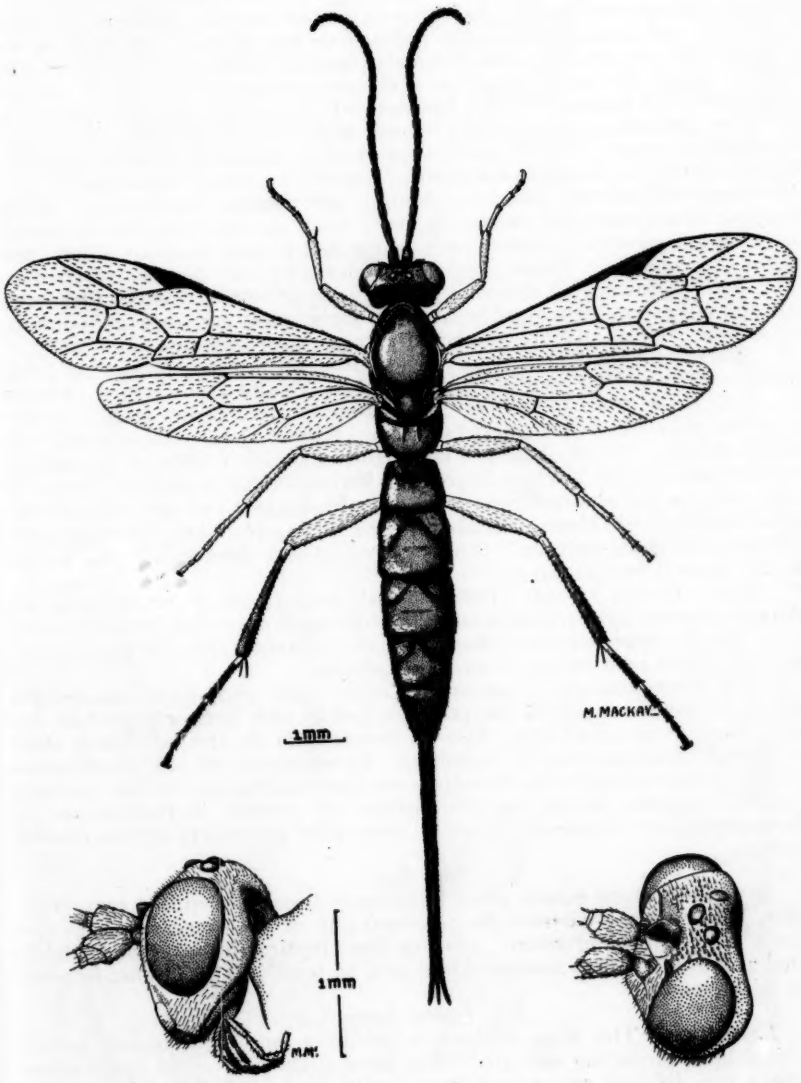
The Adult

The adult of *Glypta fumiferanae* was described by Viereck (8) in 1912 from material reared from the spruce budworm. A dorsal view of the female and details of characteristic head structures are illustrated in Plate X.

As the original description of this species is very short and incomplete, it has been found necessary to redescribe it as below.

*Contribution No. 2374, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

PLATE X



Adult of *Glypta fumiferanae* (Viereck), showing female from dorsal view and details of characteristic head structures.

Female. Length 8 mm., ovipositor sheath length about 4.5 mm. Temples flat or slightly concave, receding posteriorly at an angle of about 30°, rather abruptly rounded posteriorly, broadest above, narrowing strongly below, especially narrow where occiptal carina bends outwards above genae to approach the eye, at this point temples distinctly narrower than width of malar space, beyond this point occipital carina evanescent. Eyes strongly convex; width of head including eyes distinctly greater than height. Clypeus strongly convex, apical margin broadly rounded and truncate at middle; malar space one and one-half times as wide as basal width of mandible. Head densely punctate, with a very large prominent tubercle formed by the convergence of the two frontal carinae above antennae, upper surface of tubercle strongly concave. Temples punctate and shining, the punctures less numerous ventrally. Face slightly broader than eye length. Mesoscutum, scutellum and mesopleura densely punctate, shining; speculum highly polished, impunctate; metapleura densely punctate; metapleural tooth prominent. Propodeum punctate, shining, the median longitudinal carinae diverging and incomplete posteriorly, very weak on some specimens; costulae absent; apical transverse carina rather strong and located at about apical three-fourths of propodeum. Basal segments of abdomen very densely punctate and rather dull; slight median elevation on first tergite; basal carinae of first tergite weak and not extending beyond basal third; three apical tergites weakly punctate only at base. Sheath of ovipositor slightly longer than abdomen.

Black; scape and pedicel black; flagellum black at base becoming brown apically. Clypeus dull reddish except at base. Palpi stramineous. Tegulae white. All coxae, front and middle femora testaceous; front and middle trochanters stramineous, hind trochanters brownish. Hind femora testaceous, narrowly blackish apically. Front tibiae and tarsi light testaceous; middle tibiae and tarsi testaceous with a slight blackish tinge which becomes more prominent toward the apex of the legs, apical tarsal segment blackish; hind tibiae and tarsi blackish with narrow basal whitish bands, whitish band on metatarsus wider, no white basal band on apical tarsal segment. Apices of second and third tergites occasionally more or less dull brownish-red.

Male. Length 7.5 mm. Differs slightly from female in having front and middle trochanters light yellowish-white. Reddish coloration on abdomen, when present, may be more extensive than in female, extending from first to fifth tergites; varies from light brown to dull brownish-red.

This species traces to *canadensis* in Cresson's key (4). From *canadensis* it differs in having the apices of the posterior femora only narrowly blackish, not broadly black as in *canadensis*. Also, in *fumiferanae* the frontal cone is much more strongly developed than in *canadensis*. In *canadensis* the propodeal carinae are much more extensively developed, the median longitudinal carinae attaining the apical transverse carina. and the costulae are present; in *fumiferanae* the median longitudinal carinae are weak and incomplete posteriorly and the costulae are absent.

The Egg

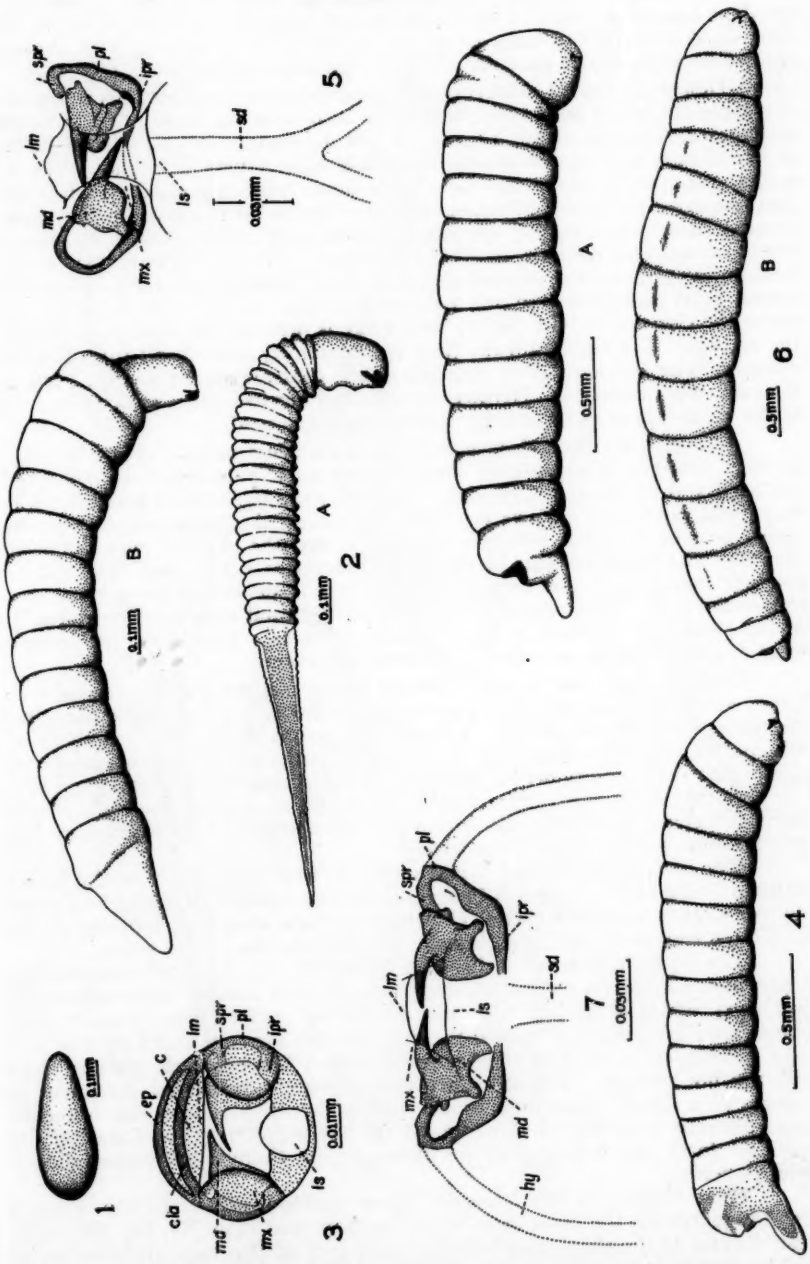
A newly-emerged female adult was dissected and unfertilized eggs (Plate XI, Fig. 1) were removed from the proximal end of the ovarioles. Eggs thus obtained were whitish in colour, more or less elliptical in shape and slightly pointed at one end. They measured 0.43 mm. in length and 0.18 mm. in width at the widest point.

The Larval Stages

First Stage. This stage is characterized by a long, light brown, heavily sclerotized head projecting ventrally. The larva at the end of the first stadium presents a very different appearance from that of the newly-hatched insect. For this reason the writer has divided this stage into early and late first-stage.

The early first-stage larva (Plate XI, Fig. 2A) has a body composed of a head and thirteen segments. The last segment projects posteriorly in a long, narrow, caudal appendage which is almost as long as the remainder of the body. The cuticle in this stage is very wrinkled. The body is soft and cylindrical.

PLATE XI



IMMATURE STAGES OF *GLYPTA FUMIFERANAE* (VIER.)

The late first-stage larva (Plate XI, Fig. 2B) consists, as before, of a head and thirteen body segments. In this particular stage, however, the caudal appendage has shrunk until it is only about one-sixth the total length of the body. Both early and late first-stage larvae are creamy white in colour, with the exception of the light brown head capsule. No spiracles are present in this stage.

Despite this great difference in appearance, the head measurements of the two types cover the same range. Also, in both cases the head projects ventrally and the mouth-parts (Plate XI, Fig. 3) are the same. The cuticle of the head, as has already been noted, is sclerotized and light brown in colour. The mandibles (md) are pointed and each has a heavy base articulating above with a short superior pleurostomal ramus (spr) and below with a broad, heavy inferior pleurostomal ramus (ipr). The inner, lower ends of the inferior pleurostomal rami are projected medially to meet each other. The labiostipites (ls) lie above this central bar. A thin pleurostoma (pl) joins the superior and inferior pleurostomal rami on either side and continues dorsally to form the epistoma (ep) above the clypeus (c). A clypeal arch (cla) is present over the upper border of the clypeus. The small labrum (lm) is very faintly marked off from the larger clypeus. The maxillae (mx) are thin lobes, difficult to distinguish, lying over the base of the mandibles. Neither the silk duct nor its opening were seen on any of the head capsules of this stage which were examined.

Second Stage. Second stage larvae of *Glypta fumiferanae* (Plate XI, Fig. 4) are very different in appearance from the first stage, particularly in the shape of the head and the caudal appendage. In this stage the head is hemispherical in shape and no longer projects ventrally. However, the head and the first three body segments are turned slightly ventrad, so that the anterior part is somewhat curved. The trunk consists of thirteen segments as before, but the caudal appendage now projects somewhat ventrally and is smaller in proportion to the rest of the body, being about one-seventh of the total length. The dorsal part of the thirteenth segment is bent slightly upwards. The larva, including the head, is creamy white in colour. Spiracles are absent.

Tothill states that his second-stage larvae may be a composite of several instars and notes that there is a great range in size and width of the head in the specimens which he examined. However, he points to the fact that there is an "absence of structural differences in the head capsules other than those depending soleiy upon size", as support for grouping all the specimens as second-stage larvae.

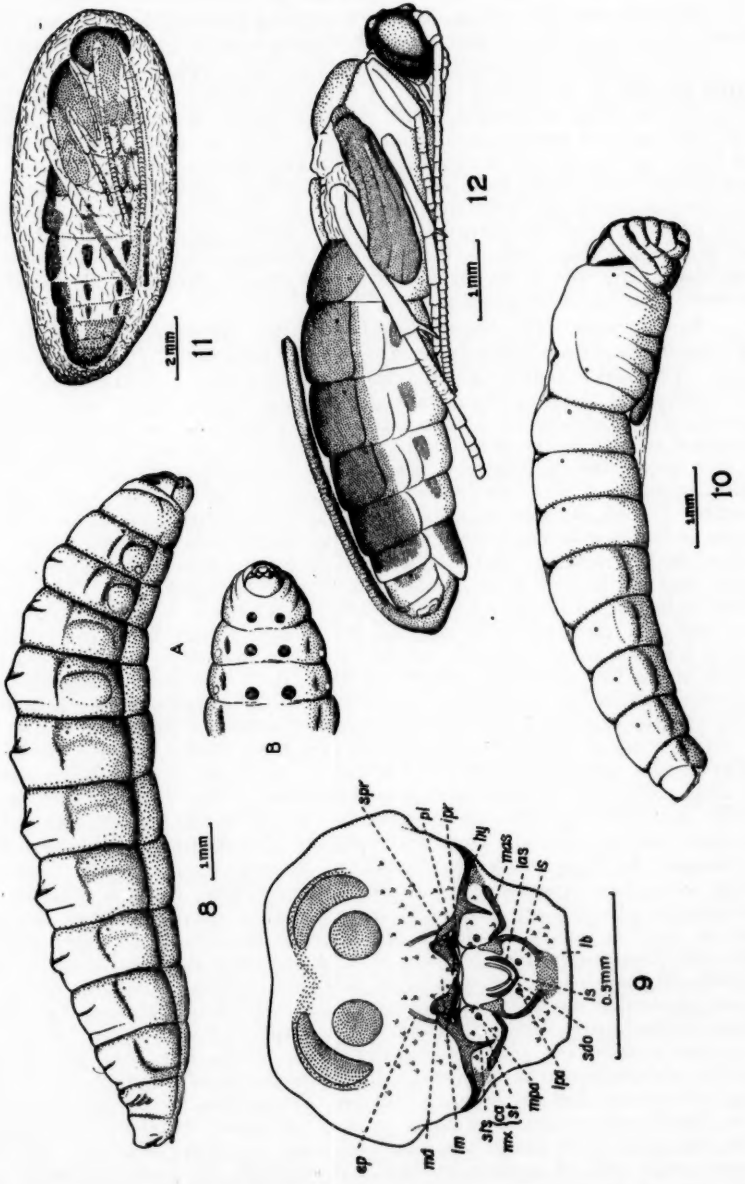
As the writer recognizes four larval stages in comparison with Tothill's three, it seems evident that the second and third stages of the former are represented by the second stage of the latter.

The recognition of four larval stages, as well as the form of the cephalic skeleton of the various stages is in agreement with conditions found by Cameron (2) for *Glypta haesitator* Grav. Crawford (3) also described four larval stages for *Glypta rufiscutellaris* Cress., but did not describe the mouth parts.

The cephalic skeleton of this stage (Plate XI, Fig. 5) is not well developed. A pleurostoma (pl) is present, bearing superior and inferior pleurostomal rami (spr, ipr) which articulate with the mandibles (md). The inferior pleurostomal rami are produced toward the mid line but are now much narrower and more inconspicuous than in the first-stage larva. The epistoma and the clypeal arch are not present. The silk duct (sd) is visible in cleared specimens and appears as a lightly pigmented brown tube which divides into two branches a short distance posterior to the edge of the labiostipites (ls). Labrum (lm), maxillae (mx) and labiostipites are inconspicuous fleshy lobes surrounding the mouth opening.

Third Stage. In this stage the larvae increases greatly in size. Plate XI, Fig. 6A, represents the larva early in the stadium and Plate XI, Fig. 6B, a larva near the end of the third stage. In the early part of this stage the head is bent slightly ventrally; later it points anteriorly as in the succeeding stage. The colour of the larva is the same as that of the second stage. The caudal appendage of

PLATE XII



IMMATURE STAGES OF *GLYPTA FUMIFERANAE* (VIER.)

this stage is again shorter in proportion to the body, being now about one-eighteenth of the total length. As in the second stage it is a small ventral knob on the thirteenth body segment. No spiracles are present in this stage.

Tothill notes the presence of leg, wing, and antennal buds toward the end of his second stage, which most probably corresponds to the writer's third stage.

The cephalic skeleton of the third-stage larva (Plate XI, Fig. 7) is very similar to that of the second stage. A pleurostoma (pl), with superior pleurostomal ramus (spr) articulating with the top edge of the base of the mandible (md) and inferior pleurostomal ramus (ipr) which is again projected medially and bears a groove for the articulation of the knob-like mandibular condyle (co), are the most conspicuous features. The hypostoma is now faintly visible as a bar extending laterally and ventrally on either side from the point on the pleurostoma where the inferior pleurostomal ramus arises. In some cleared specimens part of the silk duct (sd) is visible. The labium (lm), maxillae (mx) and labiostipites (ls) are, as in the second stage, merely inconspicuous fleshy lobes surrounding the mouth opening.

Fourth Stage. The fourth stage larva (Plate XII, Fig. 8A) is grub-shaped and curved, the cylindrical body tapering toward both ends. It is yellow-ochre in colour . The widest point is at the level of the fifth or sixth body segment. The body consists of thirteen segments as before; the dorsal part of the thirteenth segment, which contains the anus is tilted slightly upward. In this stage a pleural membrane separating the dorsal and ventral surfaces is clearly distinguishable for the first time. Dorsal lobes are conspicuous on segments three to nine. The pleural regions are more or less wrinkled and furrowed. The lobes noted by Cameron (2) on the sides of fourth-stage larvae of *Glypta haesitator* Grav. are present in the fourth-stage *fumiferanae* larvae which have not yet emerged from the host budworm larva. Spiracles are visible for the first time. Nine pairs are present and are located near the anterior border of segments two and four to eleven inclusive. Just dorsal to the pleural membrane of segments two and three and near their posterior margins are located round areas, the rudiments of wing buds. Similar areas on the venter of the first three segments mark the position of the leg rudiments (Plate XII, Fig. 8B). The remnant of the caudal appendage, which has been reduced to a very small insignificant knob, is found on the ventral part of the thirteenth segment, below the anus.

The cephalic skeleton of the fourth-tage larva (Plate XII, Fig. 9) is well-developed and sclerotized, the parts being readily seen in a cleared specimen. The basic colour of the head capsule is light brown. The superior and inferior pleurostomal rami (spr, ipr) on each side are joined by the pleurostoma (pl). A short spur projects medially from each inferior pleurostomal ramus. From the pleurostoma the hypostoma (hy) projects laterally and slightly ventrally. Midway along the hypostoma the stipital sclerome (sts) extends ventrally separating the basal maxillary cardo (ca) from the distal maxillary stipes (st). The epistoma (ep) is poorly developed and extends dorsally for a short distance above each pleurostoma but does not make a complete arch above the clypeus. The labrum (lm) is not distinguishable from the clypeus. A narrow, sclerotized bar, not pigmented medially, extends across the edge of the labrum. The heavy, sclerotized basal part of the mandible (md) articulates above and below with the superior and inferior pleurostomal rami respectively. The distal part of each mandible is slightly curved and pointed. The labiostipital sclerome (las) forms a ring ventrally around the labiostipites (ls). The ventral part is not sclerotized as a bar but is pigmented. The dorsal ends of the labiostipital sclerome are enlarged medially. From the labiostipital sclerome on either side the maxillary sclerome (mas) extends at first laterally and ventrally, then bends laterally and dorsally toward the hypostoma. The maxillary and labiostipital sclerome bound the labiobase (lb) dorsally. A U-shaped, pigmented, ligular sclerome (lis) lies in the labiostipital area. Within the area bounded by the ligular sclerome is the curved opening of the silk duct (sdo). One pair of small round papillae is situated

on the labiostipites and also one papilla on each stipes. These are the labial (lpa) and maxillary (mpa) palpi respectively. Each palpus bears two sensillae. A number of setae are present on the head capsule, the largest of which are arranged as follows on the head illustrated: four pairs on the labrum (lm); thirteen on each genal region; three on each maxillary stipes and one on each maxillary cardo; one pair on the labiostipites; five pairs on the labiobase. The antennal rudiments are large, prominent dark-brown areas. Dorsal and lateral to each of these is a large brown area. These areas are joined medially by a more lightly pigmented line.

The Prepupa

The changes observed in *Glypta fumiferanae* during the prepupal stage follow closely those described by Morris (5) for *Exenterus abruptorius*. The spinning of the cocoon is considered as the time of commencement of the prepupal stage. The eonymphal stage appears the same as the fourth-stage larva except for the partial disappearance of the prominent lateral lobes. This stage is not as active as the fourth stage larva. As the eonymph is very similar to the fourth-stage larva in appearance it has not been illustrated.

The pronymphal stage begins when the imaginal eyes are first faintly visible. After this the body of the pronymph (Plate XII, Fig. 10) becomes more curved than previously and the regions of the pupal and imaginal body become differentiated. Constrictions appear between larval segments one and two and between segments four and five, the latter being more distinct. Thus the head, thorax and abdomen are marked off. The thoracic region becomes swollen and more cylindrical than formerly. The lateral lobes almost completely disappear and the imaginal eyes become more prominent. Late in the pronymphal stage the developing antennae, legs and ovipositor can be seen outlined.

The Cocoon

The cocoon of this species (Plate XII, Fig. 11) is very thin, transparent, and white. The pupa may be seen within it. It is spun on the balsam fir or spruce tree where the host larva was feeding and is usually attached to the needles.

The Pupa

The pupa of *Glypta fumiferanae*, of which the female is illustrated (Plate XII, Fig. 12) is of the exarate type. At first it is almost white in colour and has conspicuous brown eyes. The head, dorsal plates of the abdomen, and the ovipositor turn brown after a few days. At the same time the dorsum of the thorax, antennae, palpi, wing buds, tibiae, and tarsi turn to various shades of light brown. These colours gradually become intensified until the adult colour is attained. The pupa measures about 8.5 mm. in length, but there is considerable variation in size, even in individuals of the same sex.

DURATION OF STAGES SUBSEQUENT TO EMERGENCE FROM HOST LARVA

The length of time between issuance of the mature larva from the host and the emergence of the adult parasite may be conveniently broken down into three shorter periods:

(1) Length of time between issuance from host and spinning of cocoon. Males of *Glypta fumiferanae* have been observed to spend length of time varying from less than one day to five days in this stage; females from less than one day to three days. Lack of sufficient data prevents establishment of the exact time usually spent in this phase of the life history.

(2) Length of time between spinning of cocoon and pupation (=prepupal stage=eonymphal + pronymphal phases). Data are available for this stage from Searchmont, Ontario, in 1943 and Black Sturgeon Lake, north of Port Arthur, Ontario, in 1944. At Searchmont 15 males spent an average of 5 days in this stage and 25 females 4 days. At Black Sturgeon Lake 28 males spent an average of 4 days and 36 females 4 days in the cocoon.

Data collected at Black Sturgeon Lake on the pronymphal part of the prepupal stage show that 32 males spent an average of 3 days in this stage and 39 females 3 days.

(3) Length of time between pupation and emergence of the adult (=pupal stage). Data on this stage are available from Chalk River, Ontario, in 1942, Searchmont in 1943, and Black Sturgeon Lake in 1944. Nine males at Chalk River spent an average period of 10 days in this stage; 8 females averaged 11 days. At Searchmont 26 males spent an average of 9 days in the pupal stage and 55 males averaged 10 days. Forty-seven males from Black Sturgeon Lake spent an average of 8 days in this stage; 66 females averaged 9.5 days.

ACKNOWLEDGMENTS

The laboratory studies on *Glypta fumiferanae* (Viereck) were begun at the University of Western Ontario under the direction of Dr. J. D. Detwiler. Field studies were made at the Dominion Entomological Laboratory, Chalk River, Ontario (1942), and field stations near Searchmont, Ontario (1943), and Black Sturgeon Lake, Thunder Bay District, Ontario (1944). The writer is particularly indebted to Dr. C. E. Atwood, formerly of the Forest Insect Unit, Division of Entomology, for his many suggestions and criticisms and for his constant attention and interest in the studies; to Dr. J. D. Detwiler for his suggestions and criticisms, and guidance at the University of Western Ontario; to Dr. M. L. Prebble, Officer-in-Charge of the Forest Insect Laboratory, Sault Ste. Marie, Ontario, who assisted in arranging the final form of the manuscript; and to Miss Magaret MacKay, of the Forest Insect Unit, who prepared the illustrations. Special acknowledgment is also due to Mr. G. S. Walley of the Systematic Unit, Division of Entomology, for identifying adult specimens and for help in preparing the redescription of the parasite adult; and to Mr. D. E. Gray of the Forest Insect unit for many helpful suggestions.

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SYMBOLS USED IN THIS PAPER

c —clypeus
ca —maxillary cardo
cla —clypeal arch
ep —epistoma
hy —hypostoma
ipr —inferior pleurostomal ramus
las —labiostipital sclerome
lb —labiobase
lis —ligular sclerome
lm —labrum
lpa —labial palpus
ls —labiostipites
lse —labial seta
mas—maxillary sclerome
md —mandible
mpa—maxillary palpus
mse—maxillary seta
mx —maxilla
pl —pleurostoma
sd—Silk duct
sdo—silk duct opening
se —seta
spr —superior pleurostomal ramus
st —maxillary stipes
sts —stipital sclerome

EXPLANATION OF PLATES XI AND XII

Immature stages in life history of *Glypta fumiferanae* (Viereck).

Figure 1. Egg.
2. First-stage larva, lateral view.
A. early first-stage larva.
B. late first-stage larva.

3. Cephalic skeleton of first-stage larva.
4. Second-stage larva, lateral view.
5. Cephalic skeleton of second-stage larva.
6. Third-stage larva, lateral view.
   A. larva at beginning of stage.
   B. larva near end of stage.
7. Cephalic skeleton of third-stage larva.
8. Fourth-stage larva.
   A. lateral view.
   B. anterior part, ventral view.
9. Cephalic skeleton of fourth-stage larva.
10. Pronymph, lateral view.
11. Cocoon.
12. Pupa, female, lateral view.

NOTES ON THE ERICOIDES-DUPLICIS GROUP OF THE GENUS *COLEOPHORA* (LEPIDOPTERA, COLEOPHORIDAE) *

BY J. McDUNNOUGH,

Ottawa, Ont.

Since the appearance of Dr. Braun's article and my own paper dealing with the species of this complicated group of *Aster-* and *Solidago*-feeders in which the forewing maculation is more or less similar, I have paid particular attention in field work, especially in the Maritime Provinces, to securing long series of specimens and, whenever possible, males and females *in coitu*. In consequence I have had before me for study several hundred specimens and have made large numbers of genitalic slides of both sexes with the especial idea of trying to discover adequate characters in these organs whereby the females of the individual species may be separated. While the result in some cases has been fairly satisfactory, in others fresh complications have arisen and forced me to the doubtful conclusion that either the female genitalia in any one species show a very considerable degree of variation — a feature not well borne out by the genitalia of paired captured specimens, where available — or else that in some cases, notably in the *duplicis* complex, where the males show a small apical tooth on the left rod of the aedeagus, several species occur with similar male genitalia but with differential characters in the female organs. The matter is further complicated by the fact that the various forms appear about the same time (in the Maritimes around the middle of August) and fly together; in consequence, the possibility of a certain amount of hybridization is not shut out, although at present I am rather loathe to accept this theory as accounting for the amount of variation in female genitalia. It seems to me that extremely careful breeding will be necessary before the problem can be solved; it may be that we are dealing with so-called 'food-plant species' and that each form is restricted to a single species or to a closely related group of species of either *Aster* or *Solidago;* certain indications have been noted that rather point in this direction. In the following notes I offer the result of my studies up to the present time; they are far from complete and in some cases quite unsatisfactory but may serve to stimulate an interest in the group which will eventually lead us to a proper comprehension of the species involved; unfortunately, due to my pending retirement from the government service I shall be unable to complete the study.

*Contribution No. 2436, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

Coleophora ericoides Brn.

Coleophora ericoides Braun, 1919, Ent. News, XXX, 129; Heinrich, 1924, Mem. 68, Corn. Agr. Exp. Sta., 214 (as *ericodes*); Braun, 1940 (Oct.) Can. Ent., LXXII, 178, Pl. XII, figs. 2, 7; McDunnough, 1940 (Dec.) Tr. Roy. Soc. Can., Sec. V, 57, Pl. I, fig. 5, Pl. III, fig. 4.

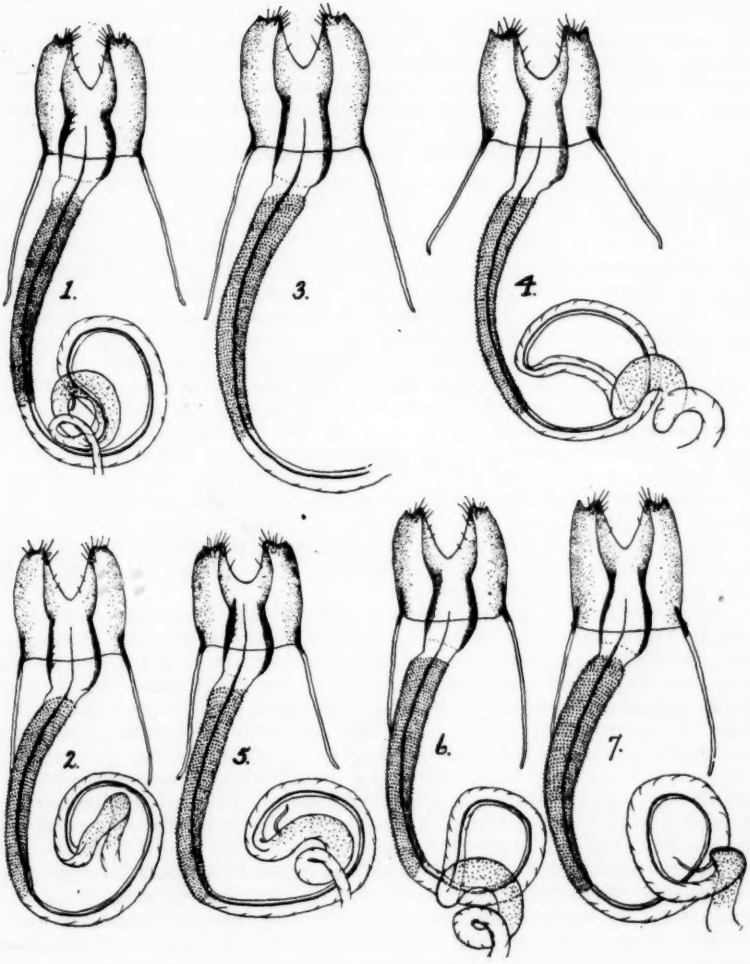
Apart from the few specimens of this species mentioned in my 1940 paper I have examined only very scanty material from the same general region. Dr. Braun has kindly supplied me with several more of her Mineral Springs, Ohio, catch of September, 1928. Two of these males match my *ericoides* slide but a third, somewhat smaller, male shows the basal spined ridge on the left side of the aedeagus characteristic of *intermediella* McD. The single female sent varies very considerably in genitalia from both Dr. Braun's and my figures of *ericoides* although the maculation (the specimen is fatty) appears similar; in this female there is hardly any contraction in the median area of the 'hour-glass' portion of the ductus and the lower half is narrower, longer and more curved to the left, being closer in some respects to my figure of *duplicis*. Dr. Braun has further sent me three specimens bred from cases on *Solidago arguta* taken in Lewis Co., Ky., on the Ohio-Kinni Divide. These specimens are much smaller than typical *ericoides* and paler with less distinct striations; the male genitalia are as in *ericoides*, however, but those of the female show considerable divergence, the ostium being shorter and rounder at the base and the lower portion of the 'hour-glass' more as in *duplicis*.

The Balsam, N. C., material, referred by Dr. Braun and myself to *ericoides* apparently consisted of a very mixed group of species. Of three specimens in our collection, originally sent by Dr. Braun as *duplicis*, one male (Aug. 18) has the genitalia of *ericoides*, another male (Aug. 15) agrees with *subapicis* Brn. in genitalia and the third specimen, a female, (Aug. 25)—as already noted in my 1940 paper—has a type of genitalia too divergent from that of *ericoides* to be satisfactorily placed under this name.

With the limited material before me it is impossible to evaluate the above differences satisfactorily and they only serve to strengthen my opinion that very careful breeding and long series plus the capture of mated pairs are the only means by which an adequate solution of the puzzle may be obtained. At the present time all that can be said is that the salient genitalic characters of typical *ericoides* appear in the male to be the *lack of any armature* of the rods of the aedeagus and in the female the *strong projection* of the inner lobes on the caudal margin of the genital plate, the rather *deep V-shaped* ostium (about 2/5 of the length of the genital plate), the *broad, upright, lower half* of the hour-glass portion of the ductus with equal chitinization on both edges and a quite short projection beyond the cephalic margin of the genital plate, its whole length being shorter than that of the upper section, and finally a *rather short, spiculate section* of the ductus, bent gently to the left, and roughly barely 1½ times the length of the genital plate. The maculation of the forewing is distinctly striate, the white veins showing up very distinctly in contrast to the light brown ground color; there is no trace of dark sprinkling in any of my typical specimens.

As regards the Nova Scotia specimens mentioned in my previous paper I am still quite doubtful as to whether any of these are genuine *ericoides*, especially in view of the fact that the food-plant, *Aster ericoides*, does not grow in this area. However, along with the White Pt. Beach specimens I have placed certain others of rather varied maculation and color of primaries from Parrsboro which in the male genitalia agree in lacking any teeth on the aedeagus and in the female organ show the *broad lower half of the 'hour-glass' portion* of the ductus. I figure (fig. 2) the female genitalia of a specimen taken *in coitu* with a male with unarmed aedeagus; this, except for the practical lack of lobes on the caudal margin of the genital plate and the somewhat greater length of the lower half of the 'hour-glass' matches up pretty well with my topotypical slide; other females, tentatively placed on account of the above-mentioned character, show frequently

PLATE XIII



Female Genitalia of 1. *Coleophora intermediella* McD. (Allotype), Bathurst, N. B.; 2. *C. ericoides* Brn. var., Parrsboro, N. S.; 3. *C. duplicis* Brn., Paratype, (rearing B. 994 on *Aster*); 4. *C. duplicis* Brn., Paratype, (rearing B. 995 on *Solidago*); 5. *C. duplicis* Brn. var. Parrsboro, N. S.; 6. *C. duplicis* Brn. (small pale form), Parrsboro, N. S.; 7. *C. duplicis* Brn. (dark form with white costa), Parrsboro, N. S.

well-developed lobes and also vary somewhat among themselves in the depth of the constriction between the halves of the 'hour-glass' and the length of the spiculate area. Such specimens crop up only sporadically with the much commoner *intermediella* and *duplicis* forms and lead to speculation as to whether such specimens may not be individual variants of one of the other species, a matter which only careful breeding can decide. None of my small Nova Scotia series at all approaches topotypical *ericoides* in the light brown coloration of the forewings and the distinct pale striation. Most of the specimens show a diffused *light gray* color with *slight dark sprinkling* and rather obsolescent pale striation. For the present all I can do is to include them doubtfully under *ericoides*.

Coleophora intermediella McD.

Coleophora intermediella McDunnough, 1940, Trans. Roy. Soc. Can., Sec. V, 59, Pl. I, fig. 7, Pl. III, fig. 9.

In 1944 a small series of 11 males and 3 females of this species was bred from cases collected from the seed-heads of *Solidago* species of the *canadensis* group in Ottawa East in the fall of 1943. Large numbers of cases were secured at this time but, due to faulty methods of hibernating the material, the net result in adults was rather unsatisfactory.

Eight male genitalic slides were made and all showed the dentate ridge on the left side of the aedeagus toward the base which is characteristic of *intermediella;* in all but one specimen the apices of the rods were unarmed, this one showing a minute apical tooth on the left side which corresponds to a certain variant mentioned in the original description. Of the genitalia of the three females, two matched quite closely with the figure given except that the ostium was more distinctly V-shaped and less rounded at its base; in the third specimen the construction of the chitinized, initial portion of the ductus was less obvious and the distal edge of the right side less convex. All three showed minor variations in the size of the caudal lobes of the genital plate and the length of the spiculate area of the ductus.

In coloration my Ottawa series is slightly paler than the type series from Bathurst, N. B., but in size and general maculation very similar. There is little trace of any dark sprinkling on the primaries but (as in the types) the radial interspaces are generally somewhat suffused with a light brown which contrasts with the pale creamy ochreous of the ground color and, in consequence, in this section of the wing the striation is quite distinct. The cases are often quite numerous in a single seed-head but largely concealed in the general mass of pappus. They are quite small, averaging a little over 4 mm. in length and resemble a dwarfed case of the paler form of *bidens*. They are moderately chunky and very definitely three-valved at apex, smooth, with only traces of pappus adhering, and of a pale ochreous color.

At Parrsboro, N. S., a good series was captured around *Solidago graminifolia* along the West Bay Road, west of the Ottawa House, in the third week of August, 1943—the season being an abnormally late one—and somewhat earlier in 1944; of a number of males, the genitalia of which were examined, the majority possessed the typical form of aedeagus with no terminal spines but with a *basal ridge on the left side* with 1-3 minute spines; occasionally, however, traces of a small, apical tooth on the left side was present and this feature also occurred in one pair captured in *in coitu* in 1944. The specimens mentioned in the original description in which the basal spined ridge was lacking and the apical tooth present should apparently be transferred to the *duplicis* complex.

At Smith's Cove, Digby Co., N. S., the species was very numerous in August, 1945, along the roadsides where *Solidago graminifolia* grew in profusion; a good number of pairs were taken *in coitu* and the genitalic slides of these made it possible to evaluate fairly satisfactorily specific characters in the organs of both sexes. The presence of the spined ridge toward the base of the aedeagus of the males can be regarded as characteristic and this, apart from the much smaller size

of the whole organ, separates the species from *ericoides*. A fair percentage of the Smith's Cove males showed the small apical tooth on the left rod of the aedeagus along with the basal spined ridge but I only consider this as individual variation for the present, at least. In the female genitalia the similarity to *ericoides* is very great and at times quite perplexing, both possessing the broad lower half of the 'hour-glass' portion of the ductus; this section is generally somewhat shorter in *intermediella* and the bulge of the right side often more pronounced; a character mentioned in the original description, *viz.*, the shortness of the anterior (not posterior) gonapophyses, unfortunately, in the light of more slide material, does not hold and in the Allotype, as herewith figured (fig. 1) (a more correct figure than my original one) the length is much as in allied species. The lobes on each side of the ostium are not as strongly developed as in typical *ericoides*, the V-shaped ostium itself is somewhat broader, and the spiculate area of the ductus slightly longer; these characters, however, are difficult to evaluate, especially when compared with slides of my doubtful Nova Scotia *ericoides* and I doubt if too great stress should be laid on them.

In maculation the forewings are normally of a light fawn-brown with slight intensification of color in the radial interspaces, the veins in this region being light creamy but not as sharply defined as in *ericoides;* very faint scattered sprinkling of dark scales occurs in most fresh specimens but in worn ones is largely absent. Occasional specimens occur, notably in the females, with a distinctly deeper brown ground-color of the entire forewing; in such cases the apical pale striation is more prominent.

Coleophora duplicis Brn.

Coleophora duplicis Braun, 1921, Ent. News, XXXII, 16; Heinrich, 1924, Mem. 68, Corn. Agr. Exp. Sta., 215.
Haploptilia duplicis McDunnough, 1936, Can. Ent., LXVIII, 54.
Coleophora duplicis Braun, 1940, Can. Ent., LXXII, 180, Pl. XII, figs. 4, 6; McDunnough, 1940 (Dec.), Trans. Roy. Soc. Can., Sec. V, 60, Pl. III, figs. 7, 8.

What I refer to as the '*duplicis* complex' is the most complicated and puzzling collection of forms or species in an already extremely involved group. This is particularly true of the females where a number of genitalic variations occur which seem too great to be laid to the door of individual variation, especially when the size of the insect and the general coloration of the forewings is taken into consideration, but where, on the other hand (as far as my present knowledge goes), the males show a similar type of genitalia, the aedeagus being armed with a small apical tooth on the left side.

The first difficulty lies in the accurate determination of the true *duplicis*. In her recent paper Dr. Braun restricts the species to her series B. 994, reared on *Aster shortii*, which included the Holotype female, the series B. 995 on *Solidago caesia* and B. 996 on *Solidago latifolia*, the genitalia of the Holotype female being figured and a figure also given of a male Paratype from the same series, which shows the tooth on the aedeagus as noted above. In my paper of the same date I make a similar restriction, figuring male and female genitalia of Paratypes of the B. 994 rearing, kindly donated by Dr. Braun; I also have before me single specimens and slides of both sexes of the B. 995 rearings and, while the male shows the same type of apical tooth (although somewhat larger), the female genitalia—as noted in my paper—show a variation which might be considered as too great to be merely individual. I give figures (3 and 4) of both organs and would call attention to the strongly U-shaped ostium and the longer half of the hour-glass portion of the ductus in the *Solidago*-feeder (B. 995). To complicate matters neither of my drawings, although very accurately made, agrees with Dr. Braun's figure of the holotype female, which shows a very bulging right side in the lower half of the 'hour-glass' and a different shaped ostium and is superficially rather reminiscent of my *intermediella*. With my very limited material I cannot settle the matter of identity and variation but must leave it to those with access to plenty of

topotypical specimens; I would, however, suggest that it might be well to limit the name *duplicis* to the *Aster*-feeder as there is quite a possibility that the *Solidago*-feeder may prove distinct; this idea has been recently strengthened by the receipt from Dr. Braun of several specimens bred from cases found on *Solidago sphacelata* at Clifty Falls, Ind.; the genitalia of these specimens are much closer to those of B. 994 than to B. 995.

A representative of this group undoubtedly occurs in the Ottawa region but our material as yet is too limited to discuss it satisfactorily beyond stating that it appears to be a *Solidago*-feeder, no cases as yet having been found on any *Aster* species and two specimens having been bred, along with the previously mentioned *intermediella*, from cases on *Solidago* which were darker than the *intermediella* cases and partially covered with bits of inflorescence.

From Nova Scotia I have long series before me which fall into this complex; besides the White Point Beach material mentioned in my original paper numerous specimens were taken at Parrsboro in 1943 and '44; at Smith's Cove only occasional specimens occurred along with *intermediella* on the roadsides but on Aug. 18 and 19 a series was taken in late afternoon flying with *C. salinoidella* McD. around *Solidago bicolor* on the shore of the Annapolis Basin at a locality known locally as Jaggers Point. After a careful study of very many genitalic slides of both sexes I must confess that I am totally unable to form a definite opinion as to how many species—if more than one—are involved. The males all show the small apical tooth on the left rod of the aedeagus; there is some variation in the size of this tooth and also in its position, one group of specimens having it placed almost subapically. In the female genitalia there is a good deal of variation in the shape and depth of the ostium and in the length and breadth of the 'hour-glass' portion of the ductus but just how much this is worth from a specific standpoint I cannot say. I have, however, sorted the material roughly into several main groups which may, when accurate breeding can be done, prove to have specific characters. The first group contains a long series of quite small, whitish-colored specimens with little trace of either striation or dark sprinkling. Such specimens were noted formerly in my original description of *intermediella* from Bathurst, N. B., as a variant of *intermediella* but with long series of both forms available from Parrsboro I feel that it should be removed from this association. In the male genitalia the apical tooth of the aedeagus is quite small and there is *no trace* of a *basal spine-ridge;* the female genitalia I figure (fig. 6) from a specimen taken *in coitu* with a typical male.

Another group consists of specimens already mentioned in my first paper as occurring at White Point Beach and augmented by other material from Parrsboro; these specimens, as noted, have a more or less light gray ground color, with generally faint dark sprinkling, and a variably clear pale striation on the veins, best noted in the apical area. The female genitalia have already (*op. cit.* fig. 7) been figured. In another group the forewing ground-color is much deeper in color, being a rather *dark slate-gray* with the *costa* and radial veins very distinctly *marked in white,* and the antennae (especially in the female) frequently lightly ringed with brown. Besides a Parrsboro series this group includes my Smith's Cove series from Jaggers Point, in some specimens from this locality the ground-color tending toward brown rather than gray. In the male genitalia the tooth of the left rod appears to be *slightly subapical,* occasionally very decidedly so, and the claspers are somewhat longer than usual. The female genitalia are figured (fig. 7) and I would call attention to the long 'hour-glass' portion of the ductus. Finally I have separated off a small series in which the ostium of the female genitalia is quite short and strongly U-shaped (fig. 5); my figure is from a Parrsboro specimen taken *in coitu* with a male with normal genitalia. The few specimens I have found of this form are rather reminiscent of a small typical *duplicis* in wing color and maculation.

Coleophora triplicis McD.

Coleophora triplicis McDunnough, 1940, (Dec.), Trans. Roy. Soc. Can., Sec. V, 61, Pl. I, fig. 8, Pl. III, fig. 5.

Distinctly a species of the salt marshes. The type series was captured on the marshes north of Bathurst, N. B., around *Solidago sempervirens* and at Parrsboro, N. S., long series were taken at dusk on the marshes near Partridge Is., again associated with the same *Solidago*. It is one of the first species in the group to appear on the wing and flies during the first two weeks of August. It is evidently very closely allied to *dextrella* Brn. but the forewings are paler and of a distinctly more ochreous shade of color than that of our paratypes of *dextrella;* the antennae, too, show practically no trace of dark annulations in the males, a feature quite noticeable in *dextrella* and mentioned in the original description. In view of the fact that what I take to be *dextrella* also occurs at Parrsboro (as commented on later in this paper), I am inclined to give *triplicis* specific status.

The genitalia in both sexes run remarkably constant to type. In the males the rather large terminal tooth on the right rod of the aedeagus is very seldom reduced or missing; the whole organ, however, cannot be definitely separated from that of *dextrella.* In the female organ, of which my fig. 5 in the original description is quite accurate, there are certain minor differences which separate the two. In *triplicis* the *ostium* is rather *shallow* and definitely rounded at its base; the terminal half of the chitinized, initial section of the ductus is considerably longer than the upper section and longer than the same section in *dextrella;* on the other hand the *spiculate portion* of the ductus is distinctly *shorter.*

Coleophora dextrella Brn.

Coleophora dextrella Braun, 1940, (Sept.), Can. Ent., LXXII, 180, Pl. XII, figs. 1, 3.

What appears to be this species was captured at Parrsboro, N. S., in both 1943 and 1944 on the higher ground, inland from the shore, where various species of *Aster* were abundant. Its main flight occurred nearly two weeks later than that of the closely allied *triplicis* McD.; the earliest date of capture was Aug. 15 and it was quite abundant on Aug. 20-24; on this latter date I captured a good series flying around an isolated patch of *Aster novi-belgii* in late afternoon, during a drizzling rain, one pair being *in coitu;* another similar pair was taken on Aug. 22.

The species, as already noted, is darker in the color of the primaries than *triplicis,* fresh specimens being a quite dark wood-brown with light sprinkling of smoky and paler striations in the costal half; frequently, however,—possibly due to a less perfect condition—there is little evidence of either dark sprinkling or pale striations; at times—but not always—the antennae are definitely annulate with brown, especially in the females. In general the Nova Scotia specimens are somewhat smaller than those of *triplicis.* In the original description *Aster cordifolius* is given as the food-plant of this species and from my observations it seems probable that *Aster novi-belgii* and possibly other *Aster* species are the food-plants in the Parrsboro region in contradistinction to the *Solidago* feeding-habits of *triplicis.*

As already noted there is little in the male genitalia to distinguish the species from *triplicis.* In the female genitalia—after a study of numerous specimens, including the two taken *in coitu*—I find that the *ostium* is deeper and decidedly more V-shaped than the rather shallow ostium of *triplicis.* The chitinized initial section of the ductus with its considerable projection beyond the margin of the genital plate and its terminal bend to the left is rather similar in both species and serves to separate them from other close allies; the walls are generally parallel but in some instances that of the right side shows a greater convexity than is indicated either in Dr. Braun's or my original figures. The spiculate portion of the ductus is quite noticeably longer than the same section in *triplicis* and the large convolution somewhat more extended. I cannot find any good characters either in the armature of the bursa or the size of the apical lobes of the genital plate.

BOOK NOTICE

THE MOSQUITOES OF THE SOUTHERN UNITED STATES EAST OF OKLAHOMA AND TEXAS,

By S. J. Carpenter, W. W. Middlekauff and R. W. Chamberlain. The American Midland Naturalist. Monograph No. 3, pp. 292. (University Press, Notre Dame, Indiana).

No other family of Diptera, nor indeed of any of the insects, has merited—or received—such a lavish expenditure of scientific skill and artistic talent, as the mosquitoes. This was true even before the Second World War, and the works of Wesenberg-Lund, Dyar, Edwards, Marshall and Matheson, to name only a few, have created a standard that it would be folly to ignore. The authors of the present treatment, all former officers of the 4th Service Command Medical Laboratory, have done well to realize this in preparing the results of their work and are to be congratulated on securing the services of so competent an artist as Mrs. Elizabeth Kaston to illustrate the text. Out of about two hundred and thirty pages of keys and descriptions, nearly half are devoted to figures of larval and adult characters. Of the classification, little need be said, since it involves no radical innovations. The descriptions are full, and those of the larvae appear to have been prepared with particular care, so as to include significant individual variation in minute characters. Although pupal diagnostic characters are discussed in an introductory chapter, the pupae have not been described. Under each description are distribution data, which include some previously unpublished records of the 4th Service Laboratory, and notes on medical importance of species where applicable. Sources of distributional and other data in the text are referred to by numbers which correspond to those in the bibliography. The index is a general one, but the page references to descriptions of species are also given in the list of contents at the beginning. The introductory chapters, which deal with general bionomics, collecting and rearing techniques, and morphology, are soundly conceived and designed to aid the beginner and non-specialist. At one point, indeed, they are not without humor. Is it not possible, for instance, to detect the faint, nostalgic echo of some long-forgotten Army Instruction, in the precise and detailed notes on how to catch mosquitoes by sitting in a damp shady place with the arms and legs exposed—and in the final unanswerable admonition "In a malarious area, this type of human exposure is to be discouraged"?

G. E. Shewell

GUELPH PRINTING SERVICE

Mailed Wednesday, January 15th, 1947